IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Applicant	:	Mitsuhiro FUNAKI et al.	
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Examiner	:	Sikyin Ip	
Title	:	COPPER ALLOY, COPPER ALLOY PRODUCING METHOD, COPPER COMPLEX MATERIAL, AND COPPER COMPLEX MATERIAL PRODUCING METHOD	
Docket No.	:	KOY-15896	
Customer No.	:	040854	

DECLARATION UNDER 37 C.F.R. §1.132

Commissioner for Patents
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Sir:

I, Mitsuhiro FUNAKI, hereby declare as follows:

1. I am a co-inventor of the above-referenced application.

2. I have a bachelor's degree of Kogakuin University complemented by 19 years of work experience in Honda Engineering Co., Ltd.

3. I recently performed a series of experiments designed to establish the criticality of the lateral extrusion conditions specified in claim 8 of the above-referenced application, namely that lateral extrusion is performed at a material temperature of 400 to 1,000°C, a die temperature of 400 to 500°C, and an extrusion speed of 0.5 to 2.0 mm/sec.

4. A copper alloy having the following composition was used in each experiment: Cr: 1.0 wt%, Zr: 0.2 wt%, Be: 0.5 wt% Ti: 1.0 wt%, B: 0.1 wt%, Cu: 97.2 wt%.

5. Table I below shows the extrusion conditions utilized in each experiment and the evaluation:

Table 1

Experiment #	Material Temp (°C)	Extrusion Speed (mm/sec)	Die Temp (°C)	Evaluation	Comments
1	<400	<0.5	<400	Fail	Unable to extrude
2			400-500	Fail	Cracks Into the Center
3			>500	Fail	Cracks Into the Center
4		0.5-2.0	<400	Fail	Unable to Extrude
5			400-500	Fail	Cracks On the Surface
6			>500	Fail	Cracks On the Surface
7		>2.0	<400	Fail	Unable to Extrude
8			400-500	Fail	Cracks Into the Center
9			>500	Fail	Cracks Into the Center
10	400-1000	<0.5	<400	Fail	Unable to Extrude
11			400-500	Fail	Cracks On the Surface
12			>500	Fail	Poor Mechanical Properties Due to Crystal Grain Growth
13		0.5-2.0	<400	Fail	Cracks Into the Center
14			400-500	Pass	OK
15			>500	Fail	Poor Mechanical Properties Due to Crystal Grain Growth
16		>2.0	<400	Fail	Cracks Into the Center
17			400-500	Fail	Poor Mechanical Properties Due to Crystal Grain Growth
18			>500	Fail	Poor Mechanical Properties Due to Crystal Grain Growth
19	>1000	<0.5	<400	Fail	Unable to Extrude
20			400-500	Fail	Poor Mechanical Properties Due to Crystal Grain Growth
21			>500	Fail	Poor Mechanical Properties Due to Crystal Grain Growth
22		0.5-2.0	<400	Fail	Unable to Extrude
23			400-500	Fail	Poor Mechanical Properties Due to Crystal Grain Growth
24			>500	Fail	Poor Mechanical Properties Due to Crystal Grain Growth
25		>2.0	<400	Fail	Unable to Extrude
26			400-500	Fail	Poor Mechanical Properties Due to Crystal Grain Growth
27			>500	Fail	Poor Mechanical Properties Due to Crystal Grain Growth

6. After lateral extrusion, Experiment #14 had an average crystal grain size of 10 μ m, a hardness of 64.2 HRB, an electrical conductivity of 93 IACS% and a thermal conductivity of 380 W/(m/K). The properties of the alloy of Experiment #14 make it particularly suitable for use in welding electrodes.

7. The alloys according to Experiments #1 to #13 and #15 to #27 are not suitable for use in welding electrodes because of reasons shown in comments in Table 1.

8. When the hardness is not less than 30 HRB, it is possible to prevent the tip of an electrode material from becoming deformed and from generating heat. When electrical conductivity is not less than 85 IACS%, it is possible to prevent an electrode material from reacting with a steel sheet and from sticking to the steel sheet. When thermal conductivity is not less than 350 W/(m/K), it is possible to prevent the deposition of an electrode material during welding because the cooling efficiency increases.

9. The method for manufacturing a copper alloy claimed in the present invention achieves crystal grain refinement to be an average crystal grain diameter of 20 μm and less, which enables the properties of the copper alloy claimed in claim 1. The copper alloys which are not manufactured by the conditions of the present invention failed as the reasons such as crystal grain growth, cracks, unable to extrude, as shown in Table 1.

10. All statements made herein of my own knowledge are true, all statements made herein on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001, and may jeopardize the validity of the application or any patent issuing thereon.

Mitsuhiro Funaki
Mitsuhiro FUNAKI

Date signed: October 2, 2008